science for global insight

Updates on GAINS development and scenario runs

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Contents

- Updating the EU emission projections

- Comparing the GAINS/HTAP with the new SSP scenarios

- Recent global GAINS projections

- Evolution of emission projections over time,
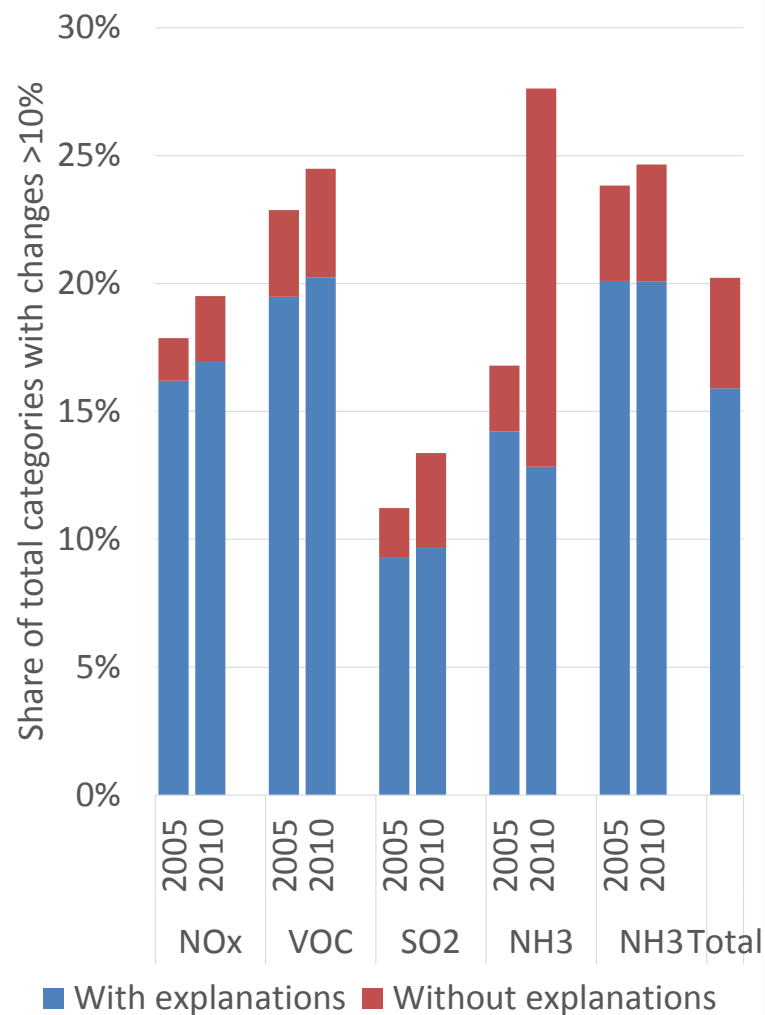 key factors leading to changes

Updating the EU emission projections for 2030
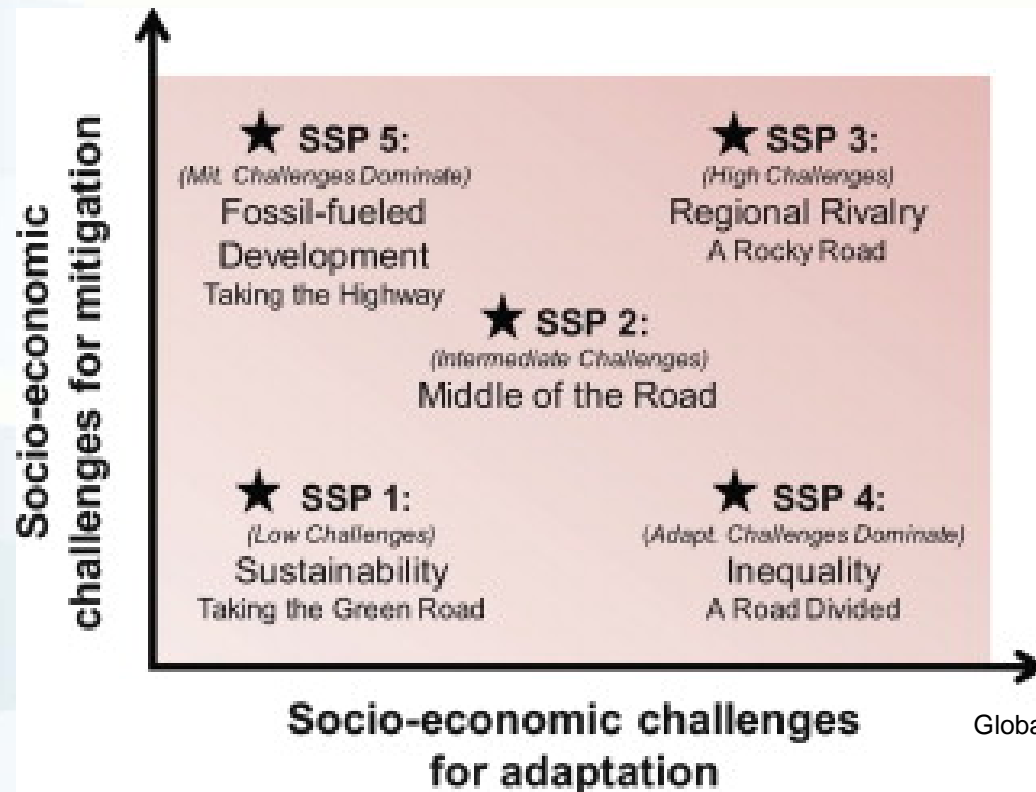
Service contract for DG-ENV:
Updated emission projections taking into account

- Inventory changes 2014-2017
- PRIMES 2016 Reference

• Determine additional actions
to meet the ERR for 2030

• Successful examples of emission reductions in the domestic and agricultural sectors

• To be presented at
Clean Air Forum 2017

# of inventory changes >10% between the 2014 and 2017 submissions for 2005 and 2010

Share of total categories with changes >10%

NOx | VOC | SO2 | NH3 | NH3 Total

2005 2010 (repeated for each category)

■ With explanations ■ Without explanations

The Shared Socioeconomic Pathways (SSP)

Socio-economic challenges for mitigation (vertical axis) vs. Socio-economic challenges for adaptation (horizontal axis)

SSP 5: (Mit. Challenges Dominate) Fossil-fueled Development — Taking the Highway

SSP 3: (High Challenges) Regional Rivalry — A Rocky Road

SSP 2: (Intermediate Challenges) Middle of the Road

SSP 1: (Low Challenges) Sustainability — Taking the Green Road

SSP 4: (Adapt. Challenges Dominate) Inequality — A Road Divided

Global Environmental Change, 2015,

SSPs are part of the framework adopted by the climate change research community to facilitate the integrated analysis of future climate impacts, vulnerabilities, adaptation, and mitigation…
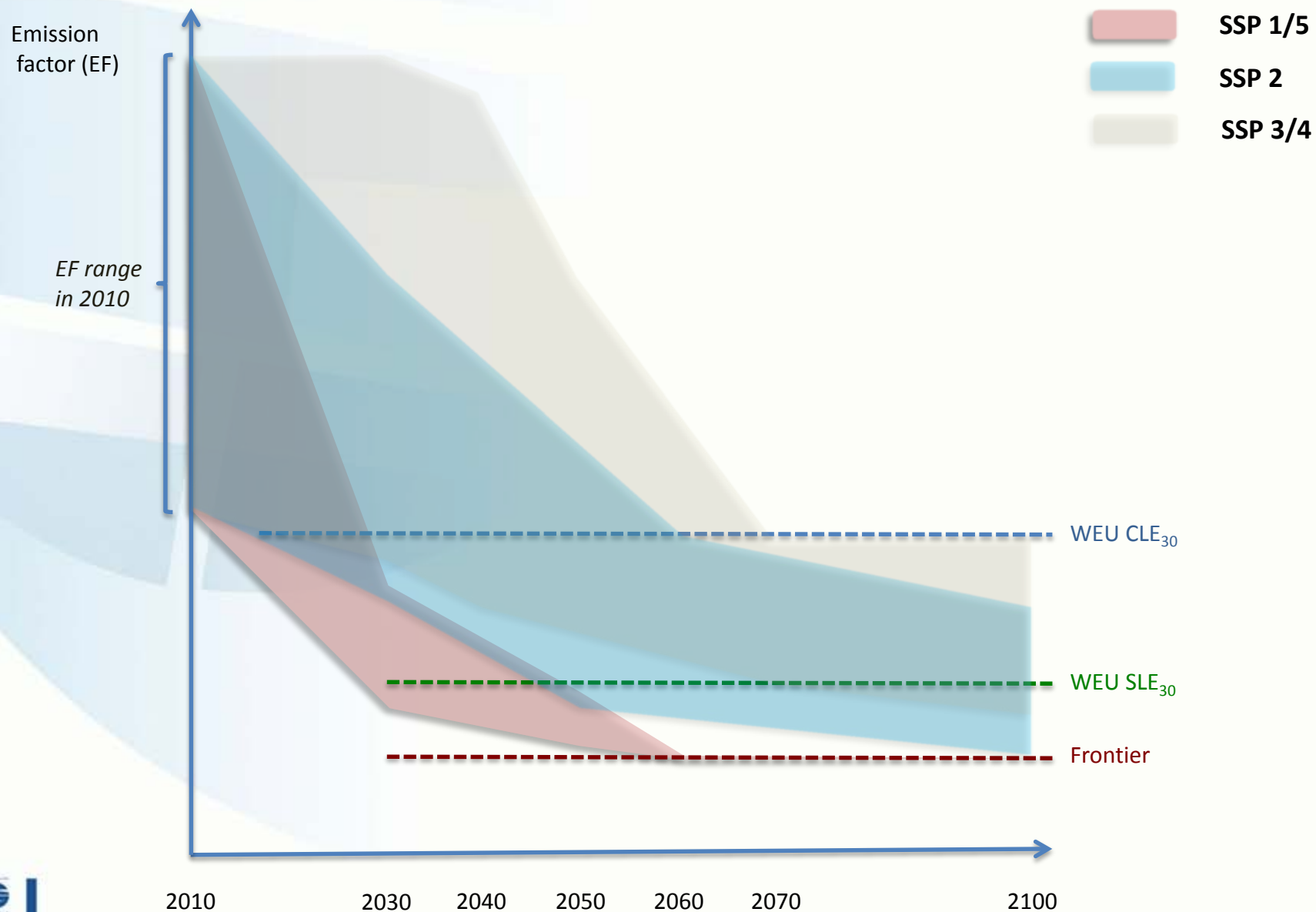
Ranges of air pollutant emissions in selected SSP and RCP scenarios (global)

Rao, Klimont, Smith et al. (2017) http://dx.doi.org/10.1016/j.gloenvcha.2016.05.012
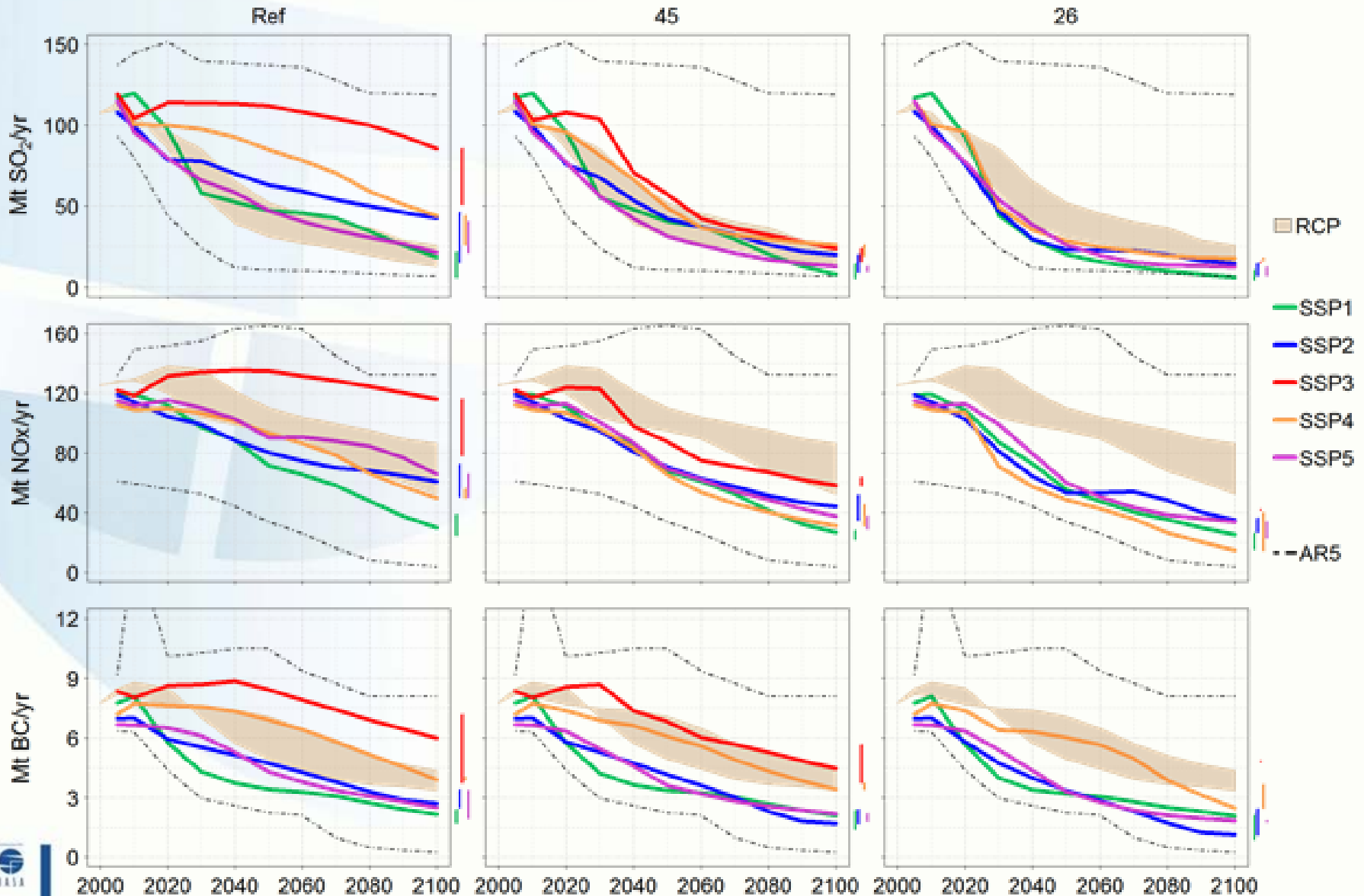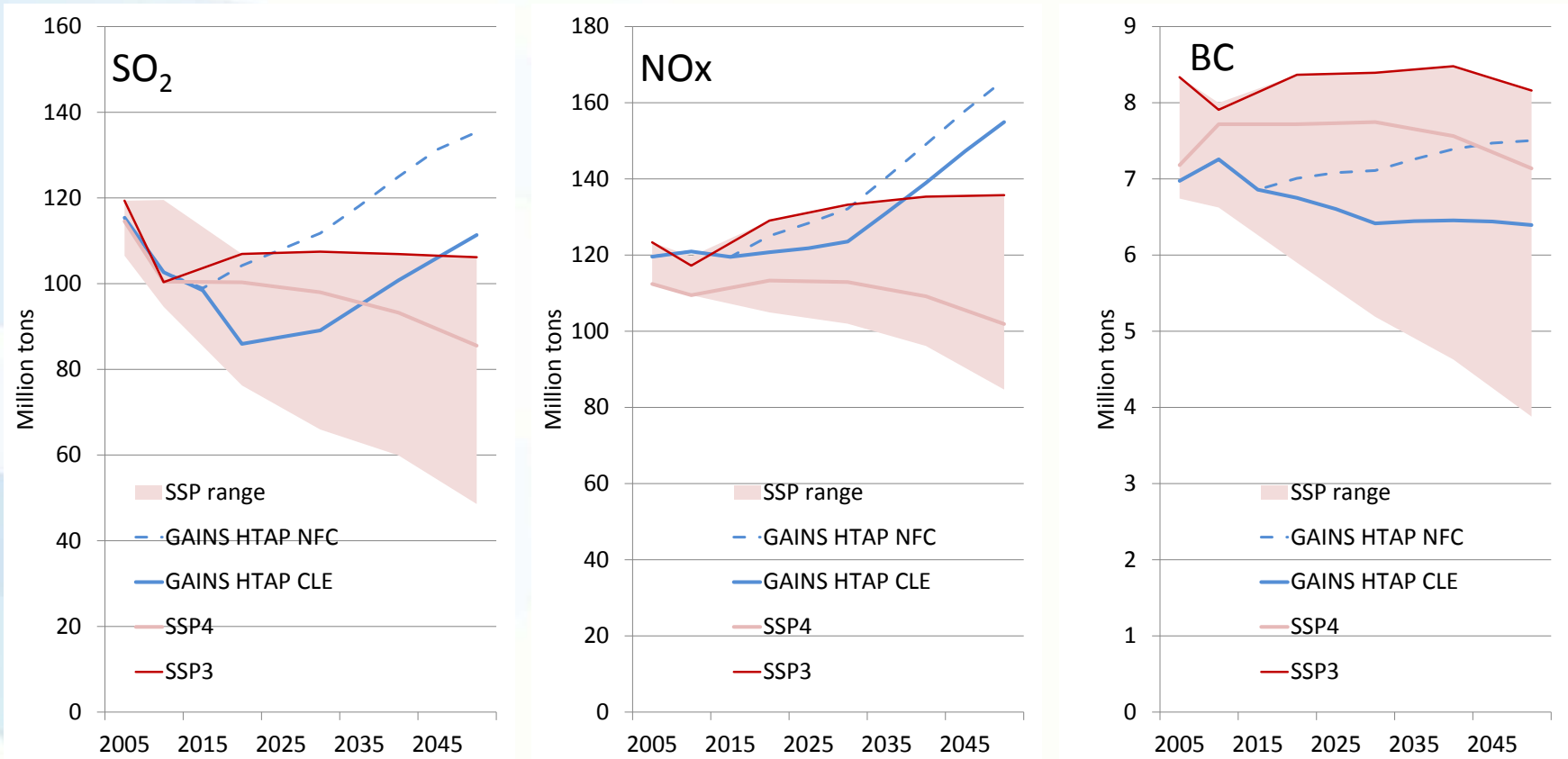
Concept of implementing air pollution (AP) policies in SSPs

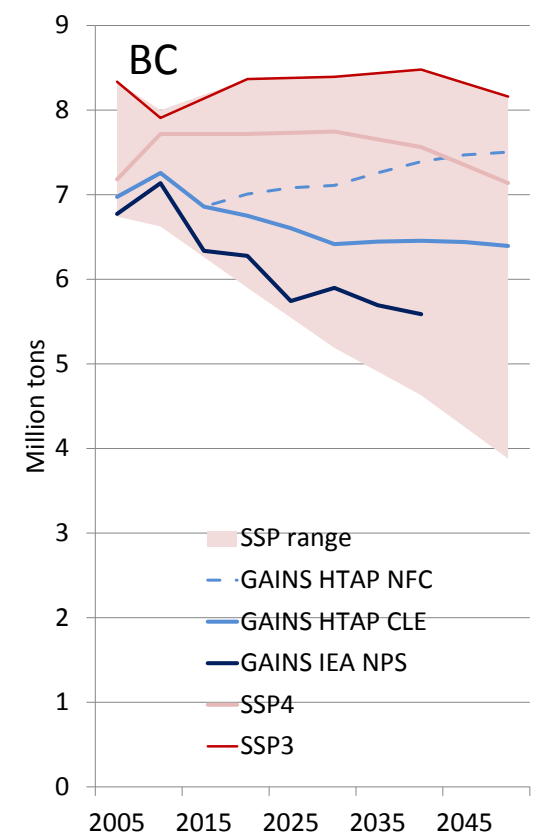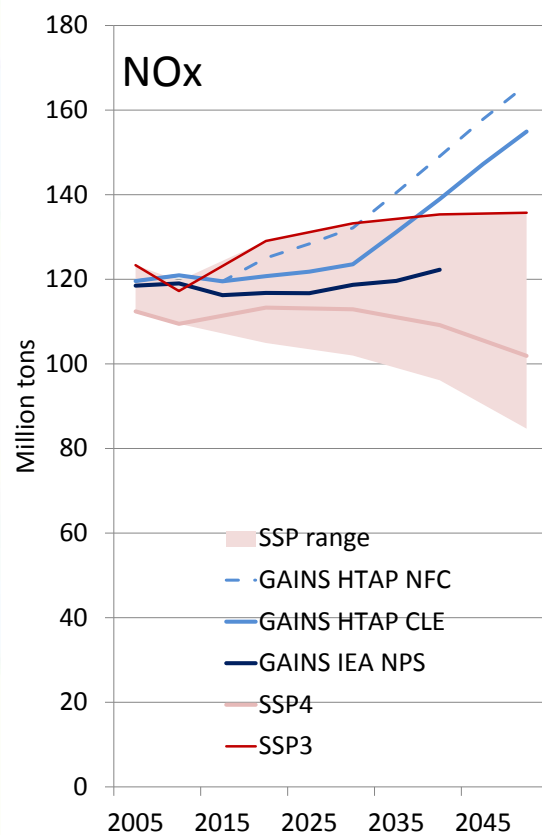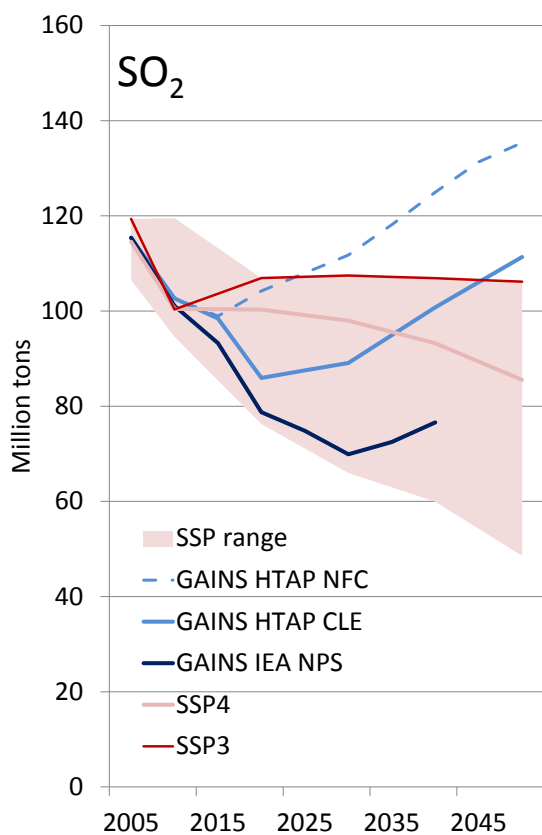Rao, Klimont, Smith et al. (2017) http://dx.doi.org/10.1016/j.gloenvcha.2016.05.012

GAINS-HTAP vs SSP scenarios (global)

Two variants of GAINS-HTAP projections:
- NFC ... No further emission controls (after 2015)
- CLE ... Effective implementation of legislation as of 2015

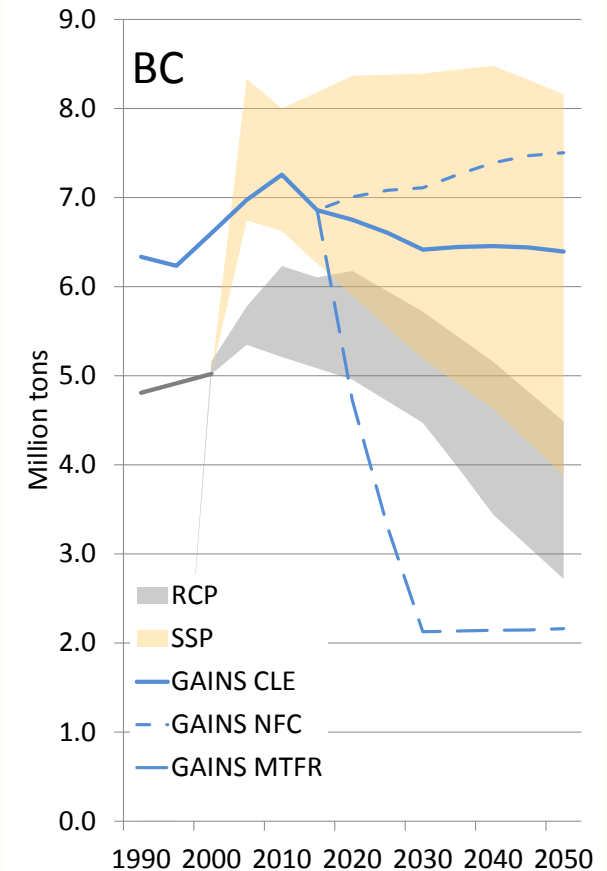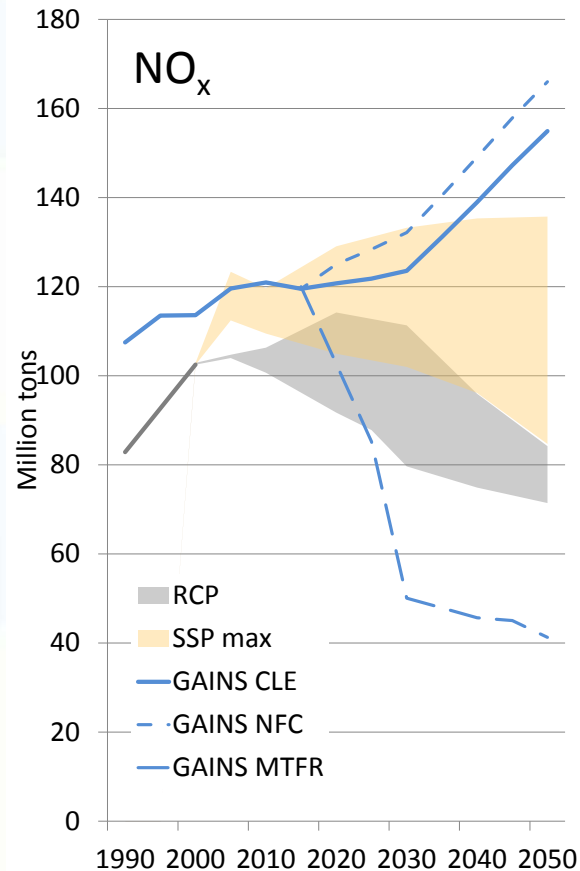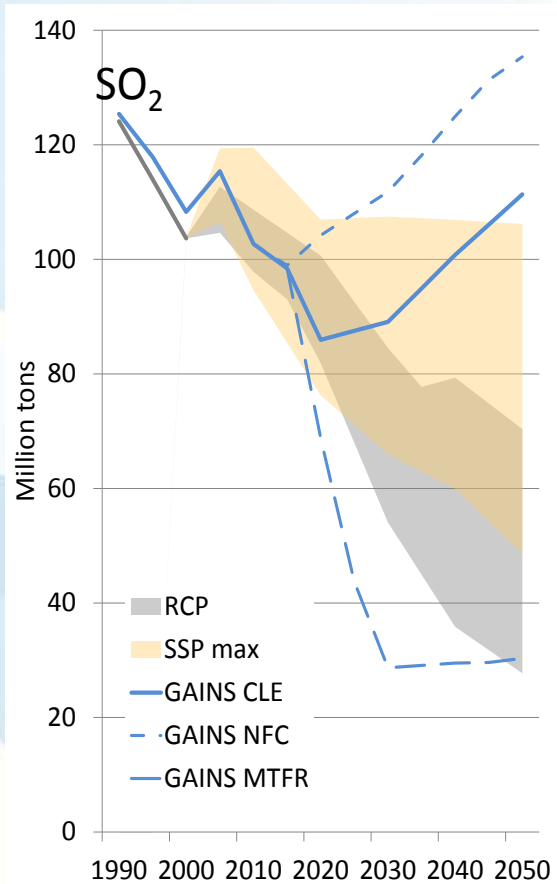# GAINS-IEA vs HTAP vs SSP scenarios (global)

Changes in GAINS-IEA (ECLIPSE 5a) vs GAINS-HTAP:
- Lower growth in energy consumptions (IEA)
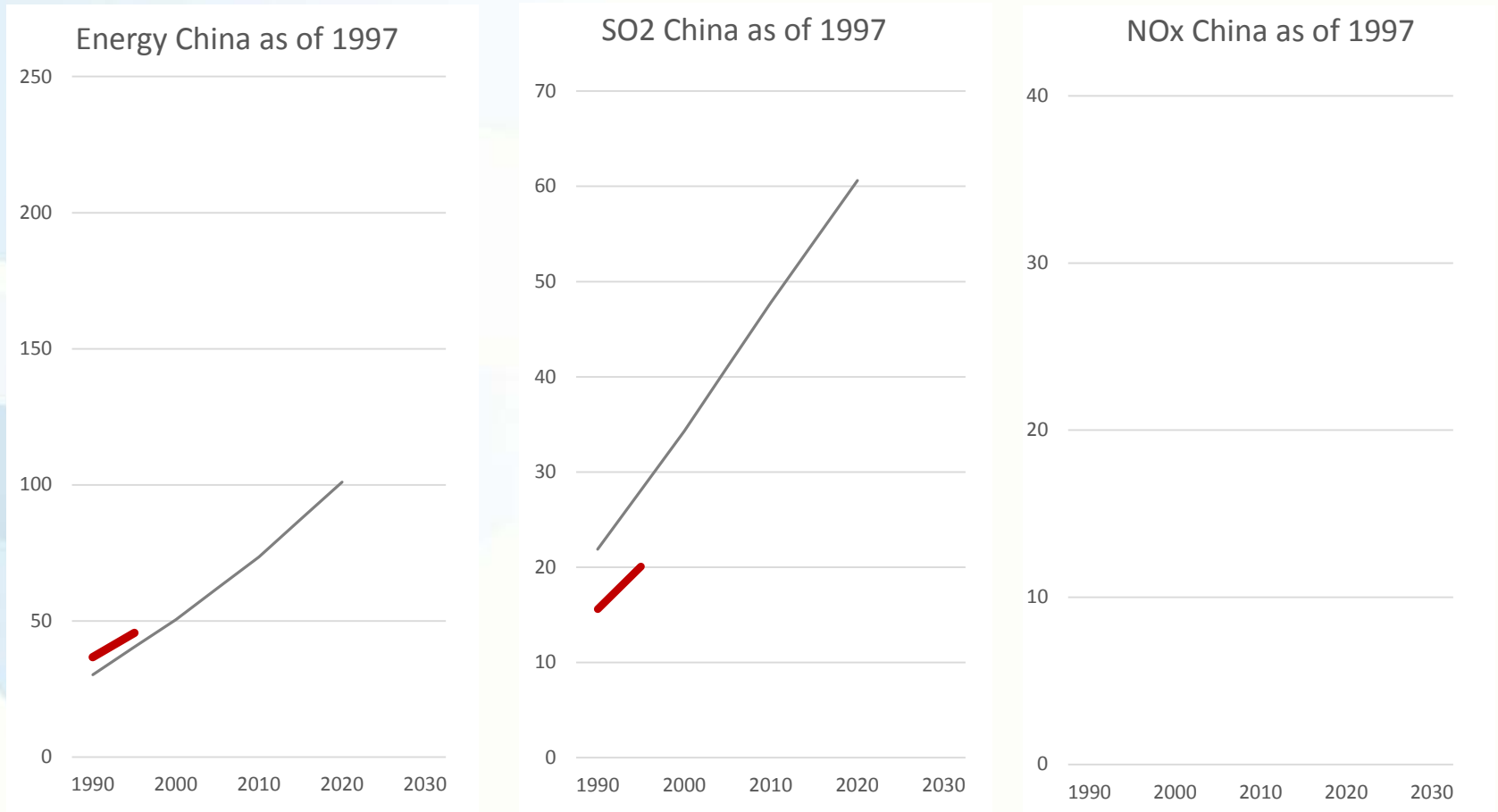- Legislation as of 2016 incl. NDC

GAINS/HTAP vs. SSP/RCP baseline projections (global)

# 20 years of 'Current legislation' emission projections

1997	2002	2007	2012	2017
Amann & Cofala	Klimont et al.	Klimont et al.	Wang et al.	Amann et al.

1997 prospects on energy, SO$_2$ and NO$_x$ emissions in China

Energy China as of 1997

SO2 China as of 1997

NOx China as of 1997

History   GAINS 1995   WASP 2001   TELLUS 2009   ACP 2014   GAINS 2017

2002 prospects on energy, SO$_2$ and NO$_x$ emissions in China

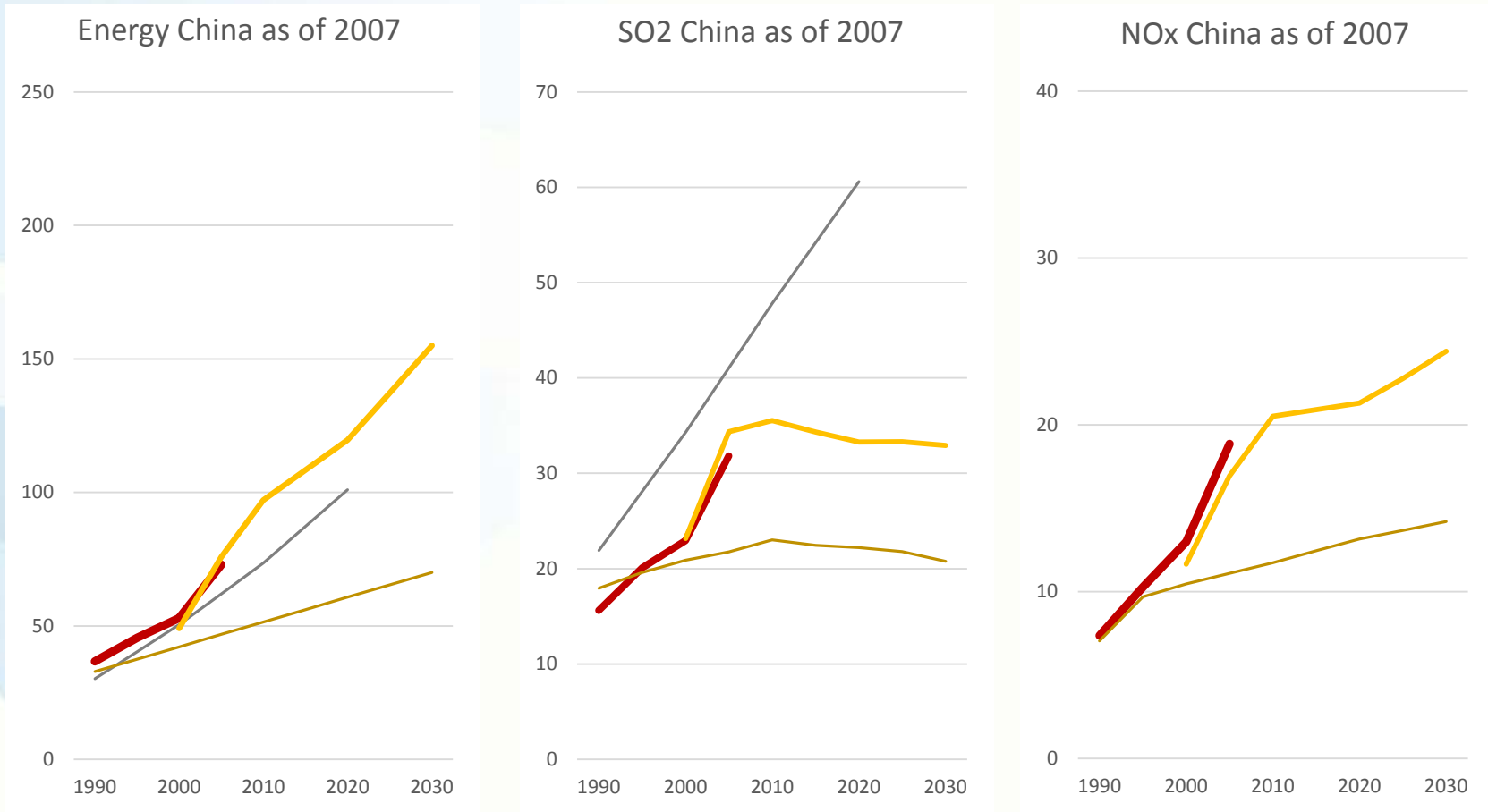**Energy China as of 2002**

SO2 China as of 2002

NOx China as of 2002
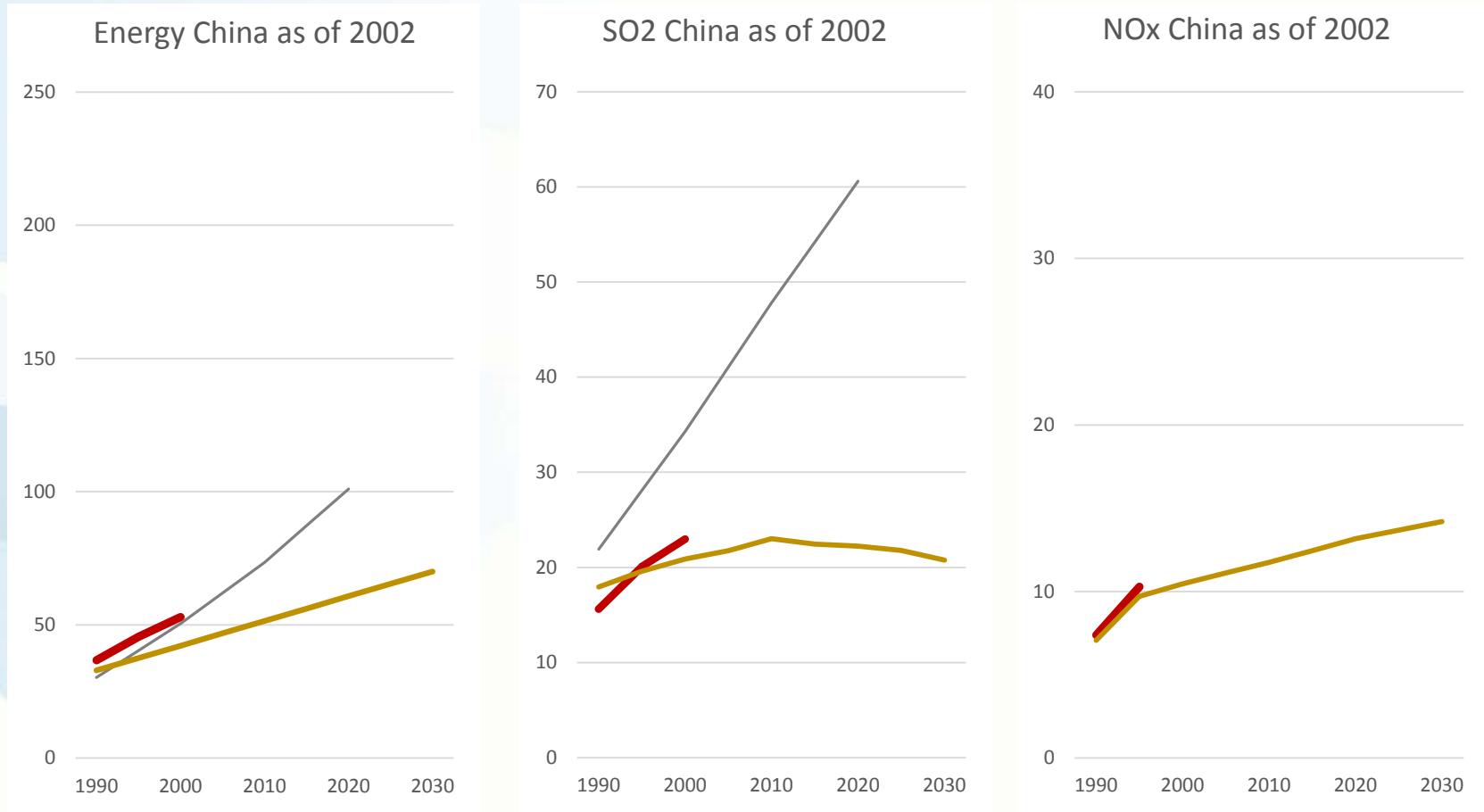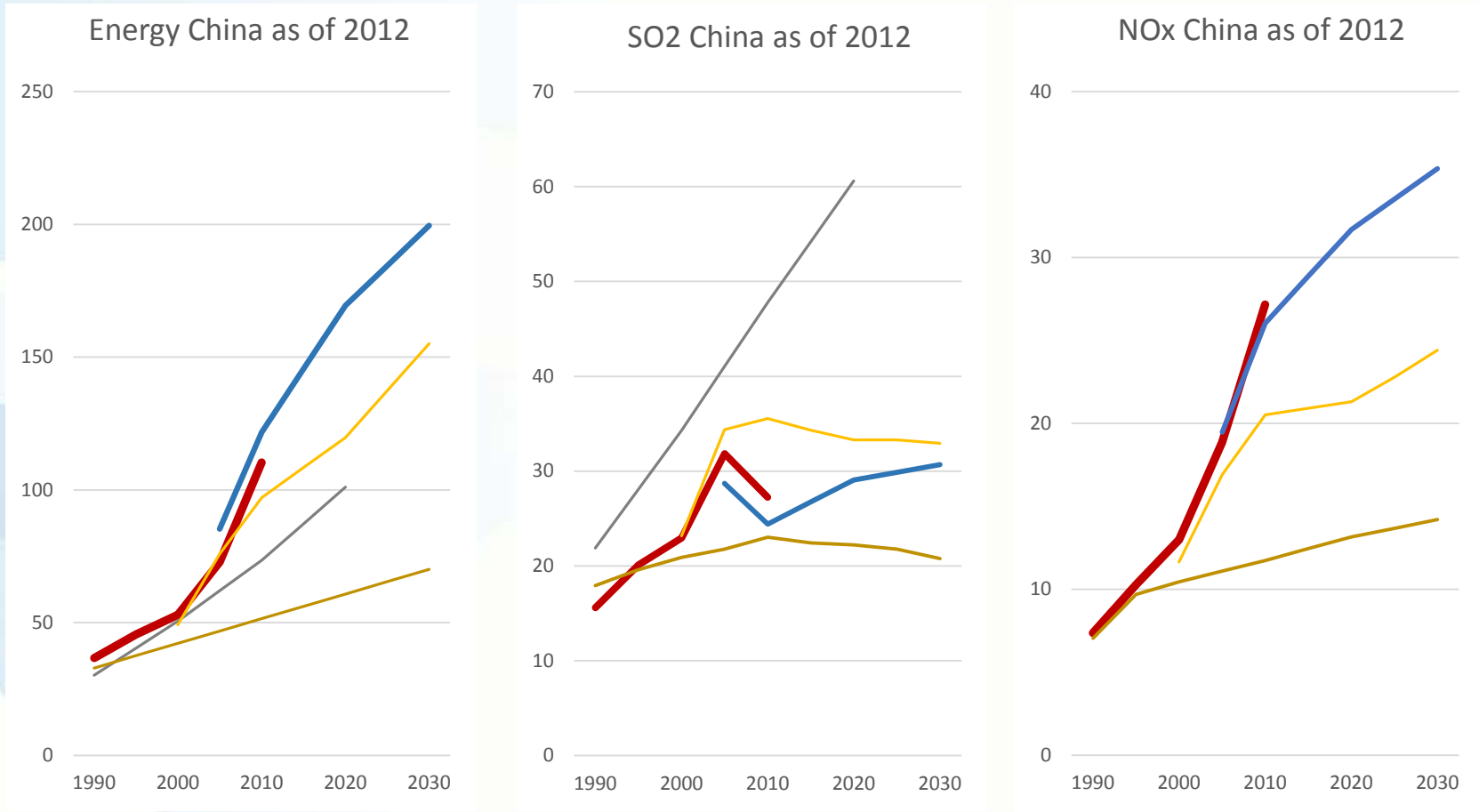
History — GAINS 1995 — WASP 2001 — TELLUS 2009 — ACP 2014 — GAINS 2017

2007 prospects on energy, SO₂ and NOₓ emissions in China

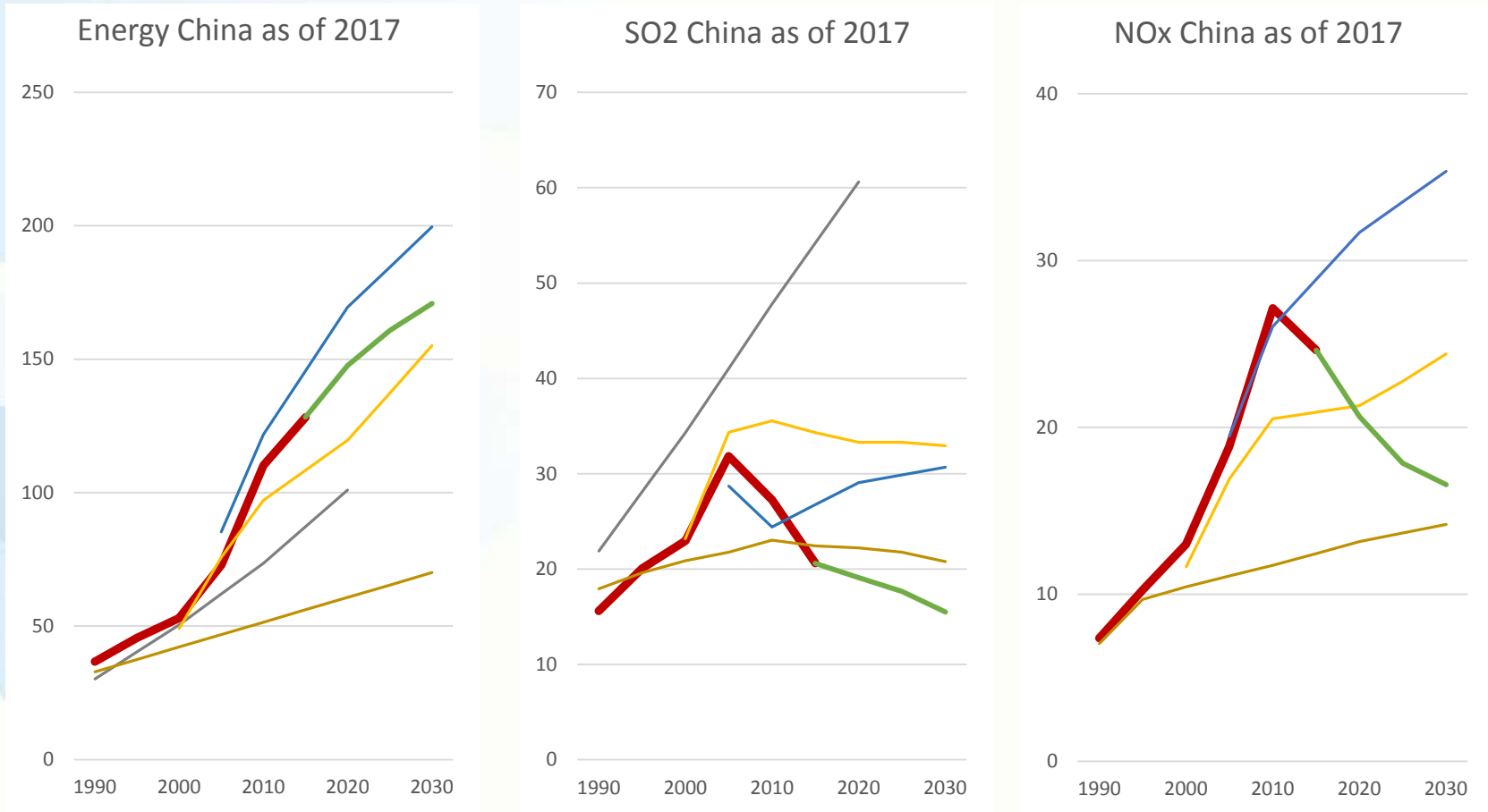# 2012 prospects on energy, SO_2 and NO_x emissions in China

Energy China as of 2012

SO2 China as of 2012

NOx China as of 2012

History ── GAINS 1995 ── WASP 2001 ── TELLUS 2009 ── ACP 2014 ── GAINS 2017

2017 prospects on energy, SO$_2$ and NO$_x$ emissions in China

Energy China as of 2017 | SO2 China as of 2017 | NOx China as of 2017

Legend: History — GAINS 1995 — WASP 2001 — TELLUS 2009 — ACP 2014 — GAINS 2017

20 years of emission projections in India

Energy India — SO2 India — NOx India
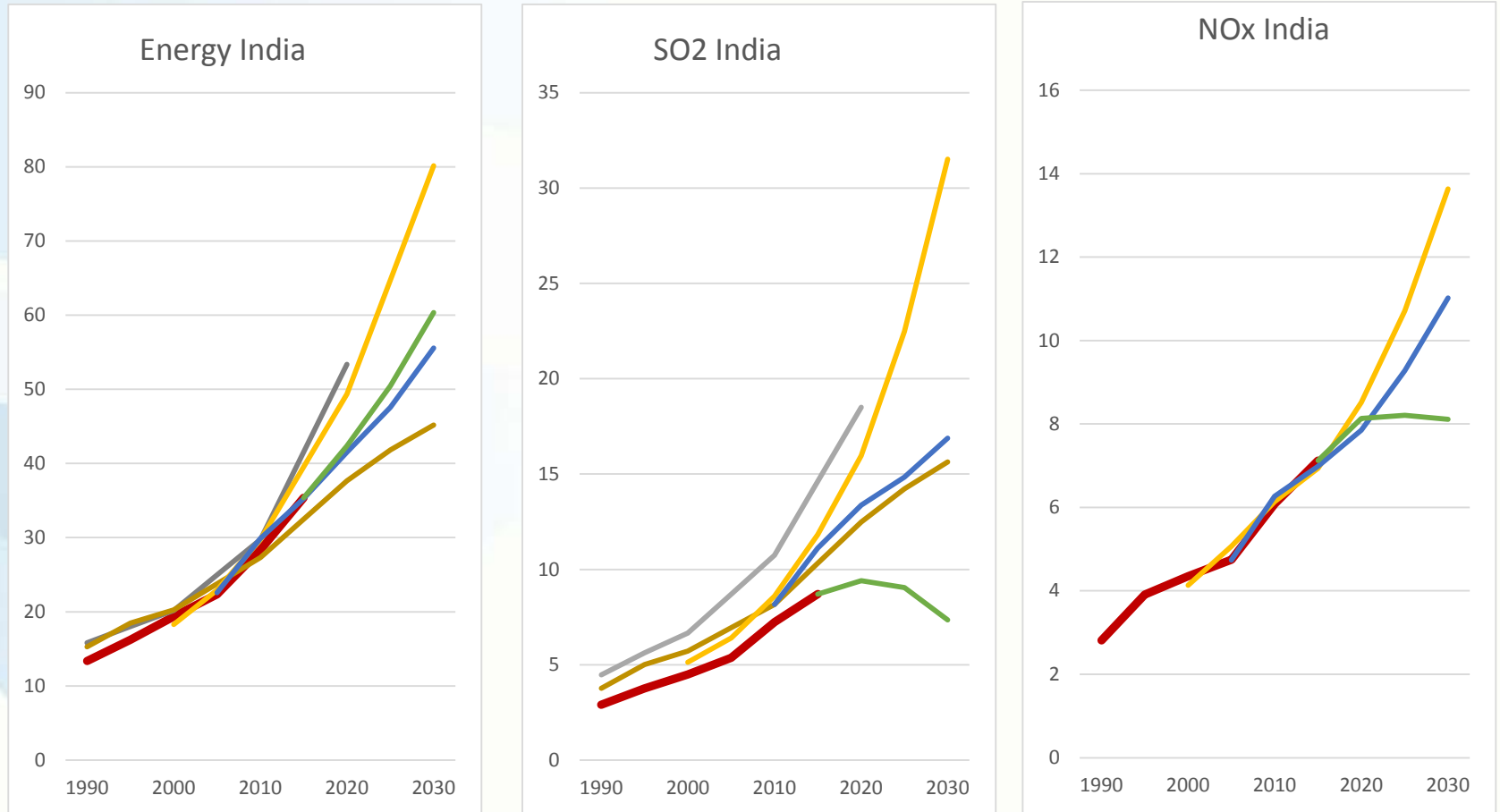
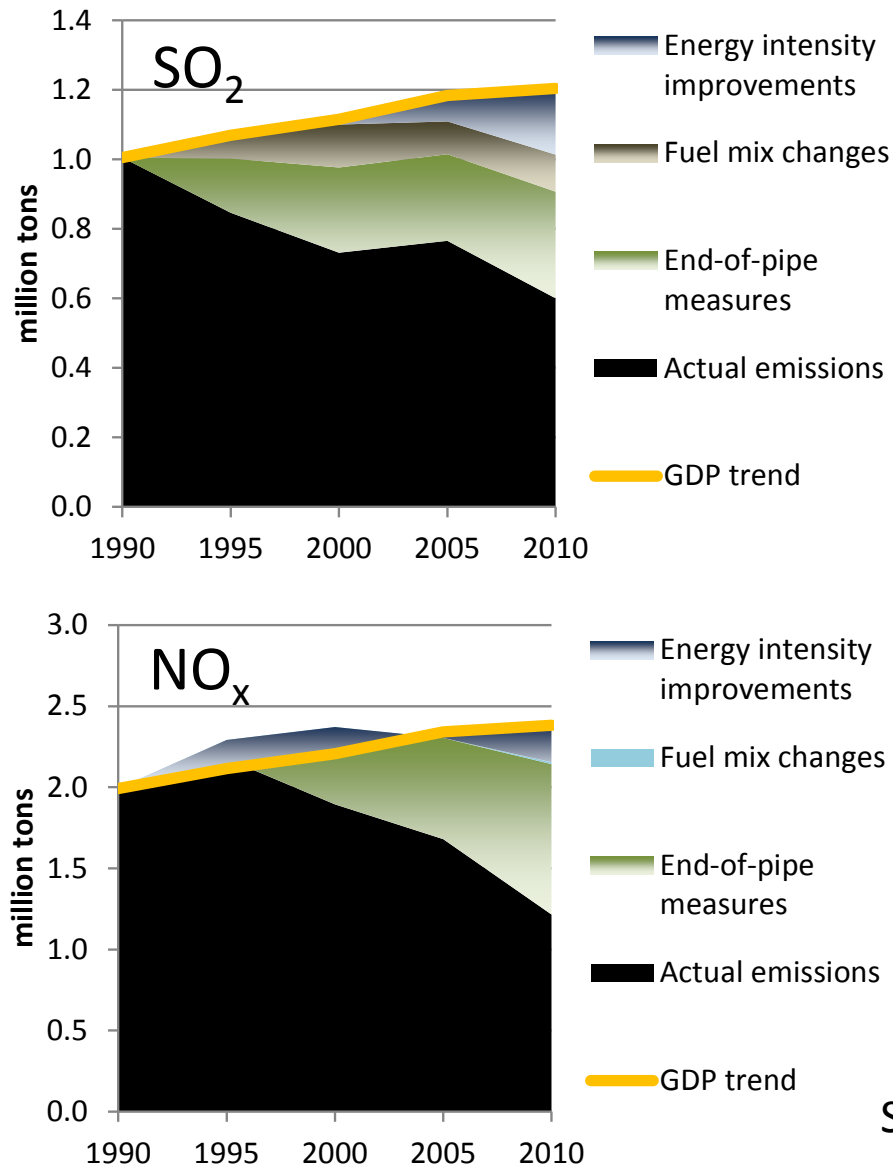History — GAINS 1995 — WASP 2001 — TELLUS 2009 — ACP 2014 — GAINS 2017

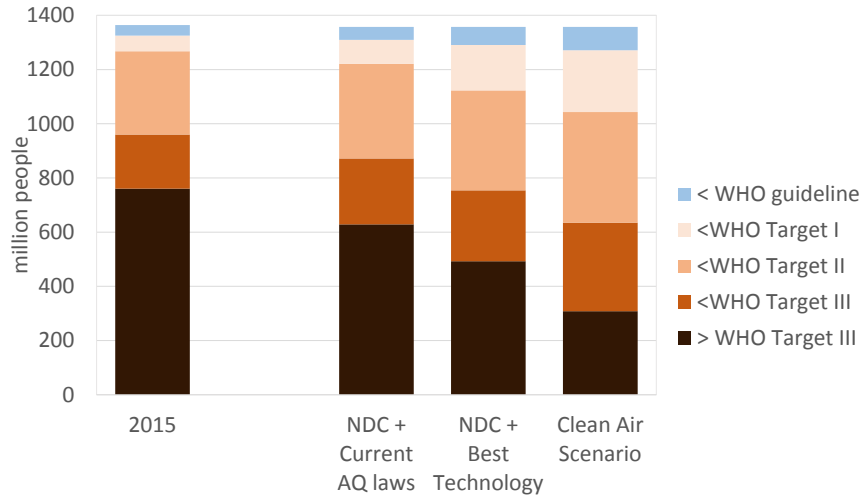# Determinants of emission changes in China
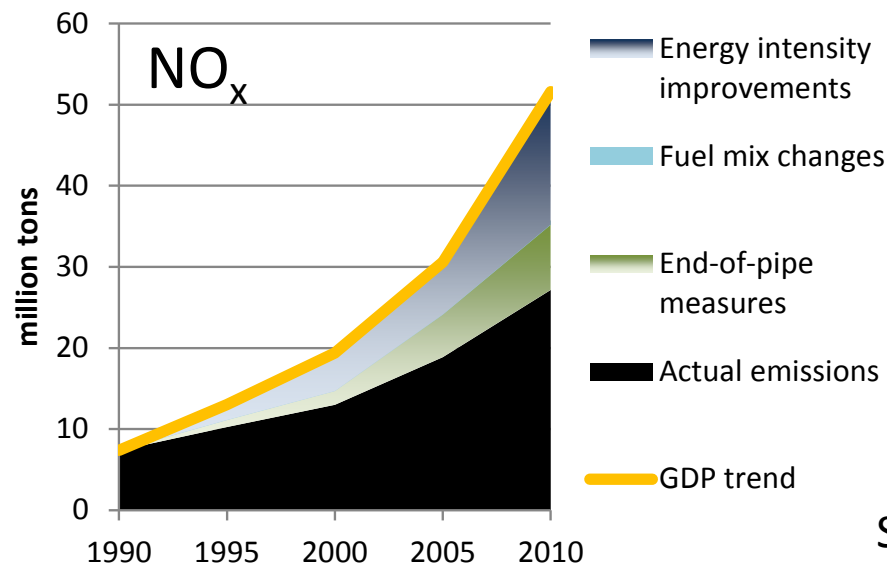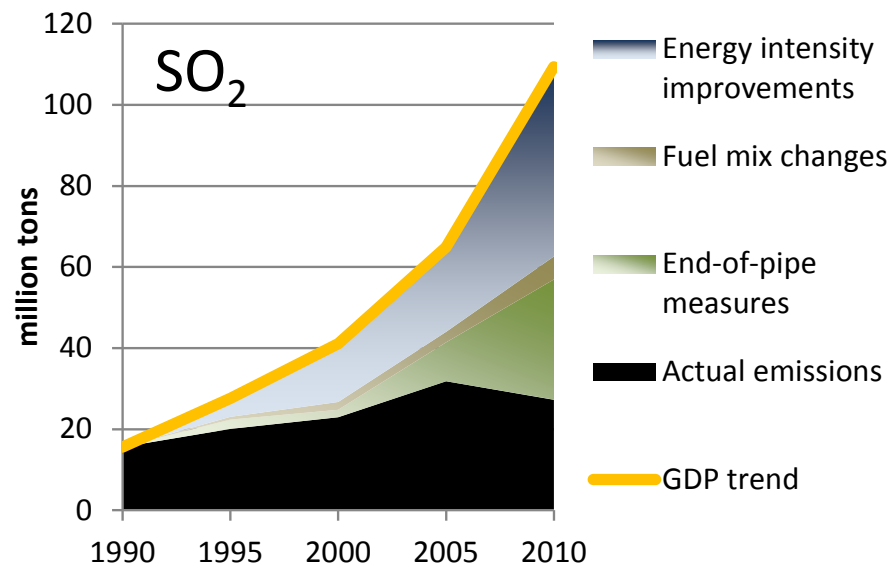
Source: Rafaj et al. 2017

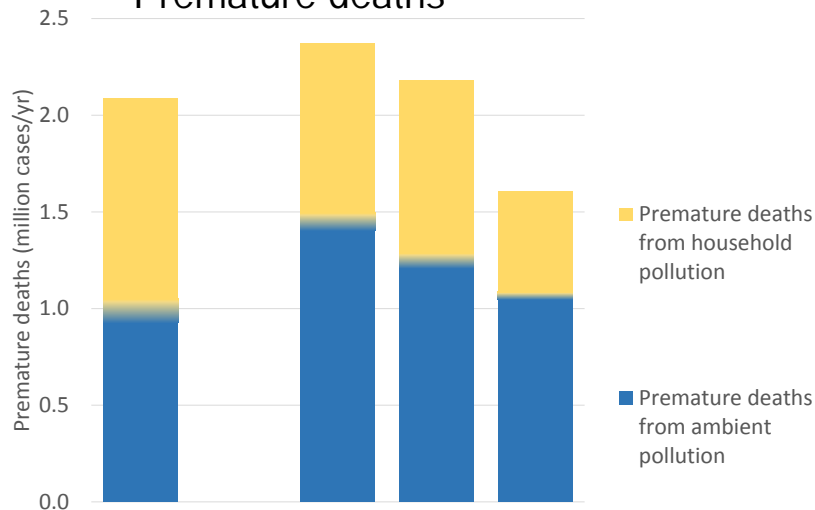# Determinants of emission changes in Japan

Source: Rafaj et al. 2017

Demographic trends, rising energy use and urbanization counteract the health benefits of intensified policy efforts

## Exposure of China's population to WHO levels for PM2.5

million people

- < WHO guideline
- <WHO Target I
- <WHO Target II
- <WHO Target III
- > WHO Target III

2015 | NDC + Current AQ laws | NDC + Best Technology | Clean Air Scenario

Premature deaths

Premature deaths (million cases/yr)

- Premature deaths from household pollution
- Premature deaths from ambient pollution

Three scenarios for 2040:

- NDCs + current Chinese air pollution legislation

- NDCs + most advanced technical emission control measures

- Clean Air scenario:
  - No fossil fuel subsidies
  - Access to clean energy
  - Waste management,
  - Energy efficiency, etc.
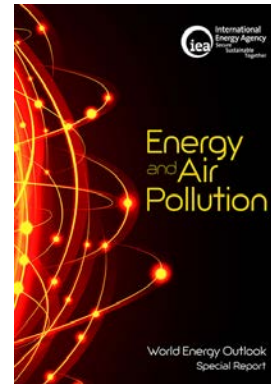
Some lessons

- The SSP1, SSP2 and SSP5 scenarios assume additional air pollution controls. Only SSP3 and SSP4 reflect current legislation and are therefore suitable for analyses of air pollution policy interventions.

- In the fast growing economies, air pollution (emissions) are strongly influenced by (absence of) policy interventions and enforcement.

- These (human/societal) factors are often hard to predict. However, the likelihood for strengthened policies increases with improved (public) understanding of the benefits of clean air.

- Demographic trends, rising energy use and urbanization will counteract the health benefits of intensified policy efforts.

Thank you!

http://gains.iiasa.ac.at